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WEST EUROPE REPORT

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CONTENTS

BIOTECHNOLOGY

SWEDISH INDUSTRIES' INTEREST IN BIOTECHNOLOGY INCREASING

Stockholm SVENSKA DAGBLADET in Swedish 18 May 82 p 20

[Article by Karin Henriksson]

[Text] "Over the past 20 years, a long list of today's raw materials have been replaced by microorganisms. Biomass consisting of household and industrial waste provides energy, blood plasma is produced by microorganisms, the forest industry's waste is converted into chemicals, oil spills are cleaned up by microbes, bacteria maximize the extraction of metal in the mining industry, and so on."

The man painting that scenario is Bertil Aberg, managing director of KabiGen. KabiGen (whose capital is equally divided between the state-owned KabiVitrum and Cardo) wrote the world's first hybrid DNA contract in 1977.

Following a great many rounds of debate and efforts to obtain permits, production of the growth hormone hGH will soon begin in Strangnas. Thanks to hGH, the six to eight dwarfs that result from every million births can grow normally. The hormone is currently produced from pituitary glands taken from corpses and is very expensive. The hGH that will soon be cultivated in 1,000-liter batches with the help of bacteria will supply all of the world's needs.

Bertil Aberg says: "The growth hormone also has another market that could not be supplied until now due to the lack of raw material. It is probable that hGH will have very good effects on both complicated bone fractures and skin burns."

Biotechnical Arrogance?

This new-old field of biotechnology is hemmed in by a long list of questions:

Will it revolutionize industrial production and create markets worth billions? Will it replace our familiar basic industries? Can we even imagine its future areas of application?

Also this: has Sweden been left behind in the international race?

There has been talk of "biotechnical arrogance"--that it takes longer and is more difficult than one thinks to transfer sophisticated biotechnical ideas from the test tube to a full-scale industrial operation.

But those sophisticated biotechnical methods--of which hybrid DNA is only one--have come to be of great importance to drug manufacturing, and their importance will soon increase. Ethanol and gas from improved fermentation processes may be able to replace large quantities of petroleum.

As to the question of whether Sweden has fallen behind, the answer is both yes and no.

Most people agree that the inflamed debate over hybrid DNA delayed things. And the regulations governing research and production are still considerably stiffer here than in the United States.

Small but Good

Sweden is naturally also small in this connection. Here we have between 30 and 40 hybrid DNA researchers, while the United States has several thousand. But research at both the Biomedical Center in Uppsala and the Institute of Microbiology in Umea is considered to be of a high international standard. In Umea, for example, according to researcher Bengtake Jaurin, two big projects are underway. Both are being carried out in cooperation with KabiGen. One is concerned with gamma interferon (the interferon that is most active), and the other is concerned with plasminogen activators (substances that dissolve blood clots). According to Bengtake Jaurin, it will be 1 or 2 years before industrial production is possible.

Like the Fortia concern in Uppsala, KabiGen is well out in front when it comes to diagnostics and drugs. The other big drug producer, Astra, feels that it really makes no difference how drugs are produced, according to research director Stig Agurell. Biotechnology will not be worthwhile unless it leads to cheaper production or unless something new can be produced. But Stig Agurell also mentions that certain biotechnical ideas are currently being studied by his firm.

Exports Already

Equipment for biotechnical research and production is already an important export item. Actually, it is a further development of old Swedish traditions--meaning separators!

Fortia is offsetting a reduced demand for biochemical equipment with increased sales of filtering and separation equipment for genetic research, among other things.

LKB Products produces laboratory equipment (turnover: about 420 million kronor), 95 percent of which is exported. Research chief Lennart Arlinger says:

"Despite Reagan's cutbacks in research appropriations, we have been more than compensated by increased sales of instruments for the analysis of biotechnical processes. A modern fluid chromatographic system that combines the biochemist's requirements with the most modern biotechnology was put on the market just recently, and it has been well received around the world."

Alfa-Laval and the Sugar Corporation (partly through the latter's subsidiary SORIGONA) are investing heavily in the next step--that is, industrial production, which will require fermentation and chemical processing facilities.

Torsten Ryhl, manager of the Sugar Corporation, says: "Thanks to 30 years of industrial experience based in part on SORIGONA's production of dextran, we have biotechnical know-how that the new genetic firms lack. We have come a long way in upgrading fermentation and in combining various biotechnical methods."

Grain into Alcohol

Alfa-Laval is only a signature away from cooperation with the Swedish Farmers Purchasing and Marketing Association in Lidkoping. Surplus grain that is currently being exported at low prices for use as hog feed will be fermented into 20,000 liters of alcohol per day. The government is contributing a portion of the nearly 40 million kronor that the facility will cost, and the OK [Swedish Oil Consumers' Union] has already announced that it is interested in blending ethanol with expensive gasoline, according to Carl-Gustaf Rosen, head of research for the Alfa-Laval industrial group.

He says: "Biotechnology is playing a part in more and more of our areas of activity. Our subsidiary Ewos, for example, produces vaccine and feed. So we are increasing our research efforts all the time."

Harald Skogman, who is head of SORIGONA (turnover: 30 million kronor), says:

"Of the world's three or four producers of the amino acid tryptophan, we are really the only one that produces it by a large-scale fermentation process. It is accomplished with the help of a genetically altered organism, and in this area we have come a long way. We are also concentrating our efforts on so-called anaerobic fermentation and methane fermentation. Several industries--food and cellulose manufacturers and breweries, for example--have expressed an interest in converting their waste into energy."

High Level of Engineering Skill

In Sweden, the government invests 22 million kronor per year in biotechnology through the STU (National Board for Technical Development) and other organizations. It is estimated by the Swedish Academy of Engineering Sciences that industry invests three times that much.

Gustaf Brunius, secretary of the Delegation for Hybrid DNA Matters, which is part of the National Board of Occupational Safety and Health, says: "With the exception of KabiGen, we missed the first race. Now the second and much more important one is coming up, and this time the development of knowledge will be the be-all and end-all. The number of people working in biotechnology in Sweden is critically on the low side.

"One obstacle is the fact that this phase--developing molecular and engineering skills--is terribly expensive. The rate of 'laboratory inflation' is high:

price increases on special chemicals are amounting to close to 50 percent. And applied microbiology is not highly regarded in Sweden."

Gustaf Brunius also talks about activities at the Foundation for Biotechnical Research (which has 25 Scandinavian firms as members). The foundation raises money for certain kinds of basic research, but it also has the job of disseminating information on biotechnology. A series of courses intended for the firms are currently being planned.

Gustaf Brunius says: "The foundation wants to help see that researchers' ideas become finished products. New bioengineering firms should be small firms of the entrepreneur type which can absorb fresh ideas but which can also be phased out if necessary."

Prepare!

Gordon Edge comes to visit from Great Britain from time to time. He is head of a department in the international consulting firm of PA International, which has a subsidiary in Sweden called EF Business Development. Biotechnical research is also conducted by PA International. His opinion and advice are as follows:

"Sweden is good at technology and at developing technology. In this case, people in every firm should sit down and think about it this way: how are my products threatened by biotechnological progress, and how can I myself use biotechnology in the future?"

In Gordon Edge's scenario, genetic engineers may drive the wool and silk fiber produced by sheep and silkworms off the market. Petrochemical plastics will be replaced by biotechnical polymers with superior qualities. Environmental poisons in the air and water will be measured quickly by biotechnical methods. And looking into the future, he says there are signs that light will be produced using the characteristics of fireflies.

How prepared are the industries that are usually mentioned in these biotechnical visions of the future?

Chemistry: Around the turn of the century, biotechnology may become a substitute for petrochemicals, according to Erik Brandt, managing director of the Association of Swedish Chemical Industries. He points out, however, that raw materials for bioengineering processes are also becoming more expensive. As far as fine chemicals (pharmaceuticals, for example) are concerned, a number of firms have already come a long way. Others are more or less waiting to see what happens. Erik Brandt says: "This may be a matter of education: the firms lack personnel receptive to the new technology."

Forestry: The pulp and paper industry is very receptive to the idea of using forest fuel, according to various publications from that industry's association.

Ore Extraction

Mining: Today's ore prices have caused the mining firms to show greater interest, according to Rolf Hallberg, who is in charge of research at Stockholm University's Geological Institute. A pilot project will start up this fall at the Gronhog Mine near Atvidaberg. Bacteria can be used to loosen the ore from the rock. That will reduce the ore content requirements in conventional mining, while also making it possible to recover ores that remain in mines which have already been shut down.

Plant Breeding: Experiments for the genetic manipulation of plant cells will begin in a few weeks at Uppsala University's Institute for Physiological Botany. It has not yet been possible to demonstrate that plant cells can incorporate isolated foreign DNA, according to Prof Tage Eriksson. The Svalof Corporation believes that the technology will come, but as yet it has not included it in its program.

Superficial Contacts Between Firms

Cardo's Hilleshog firm is involved in advanced research on conifers. But no information on Hilleshog's plant breeding or its view of biotechnology's possibilities can be provided. According to a directive from the managing director, he is the only one who is to give out information--and then only if one writes to him a month in advance.

Cooperation between research institutes and firms is said to be very important, and it seems to exist to a significant degree in Sweden. But does cooperation between the firms themselves--to develop new ideas and technologies jointly--exist?

"Yes," says Bertil Aberg of KabiGen, "but the contacts are still superficial, and there are not many inquiries."

11798
CSO: 3102/294

WORLD'S LARGEST BIOGAS PLANT NEAR MUNICH

Zurich CHEMISCHE RUNDSCHAU in German 21 Apr 82 p 3

[Article: "World's Largest Biogas Plant"]

> [Text] In Ismaning near Munich, the world's largest biogas plant has gone into operation. In reference to this event, the Federal Research Minister stated: "Biogas technology can achieve an important position in agriculture. Even if this technology can provide only a small fraction of the total primary energy consumed, it is still to be welcomed as a contribution to a decentralized energy production and supply system." Messerschmidt-Boelkow-Blohm (MBB) is responsible for execution of the overall project.

The new biogas facility involves a large installation which is in no way comparable to home-built plants. Through further development of the process, significantly higher gas output has been achieved. The Ismaning plant has a reaction volume of 1,000 m^3. Whereas daily gas output from ordinary biogas plants is about 1 m^3 per m^3 of reaction volume, a fourfold improvement in efficiency is expected from the new type installation. The yield is expected to reach the heating equivalent of 2,000 l of heating oil per day. The decomposed manure can be spread on fields as high quality natural fertilizer. The primary difference in comparison to other biogas installations--besides size--is phase separation. This increases the material conversion rate by about a factor of five, ensures operational safety and provides, within limits, on-demand gas production. Process heat is extracted from the decaying manure bed and delivered to the fresh biomass by a heat exchanger system. Only the surplus heat is diverted for external uses such as heating water. The heat reclamation cycle cuts the plant's operational energy requirement about in half.

The biogas generated by the bioreactor during postfermentation of the substrate is collected in a pillow-shaped storage bag. The bag floats with open side down on the manure bed at the bottom of a pit. The manure accumulates in the pit until such time as it is removed for use as fertilizer.

Advantages resulting from this new development are:

--Increase in material conversion rate by factors of 3 to 5,

--Safer plant operation,

--On-demand gas production (within limits),

--Lower operational energy requirements, about 25 percent in winter and 10 percent in summer,

--Lower insulation and maintenance costs, and

--Increased yield through storage of the postfermentation gas.

The method is potentially applicable where plant and/or animal biomass is produced in surplus or continuously accumulates as a by-product; where there is a significant, continuous demand for energy along with the potential for distributing it and where the accumulation of decomposeable materials and the emission of odors is to be prevented. Examples: food processing industry, slaughter houses, sugar refineries, dairies, distilleries and canneries.

If anaerobic decomposition takes place in the thermophilic temperature range around 55 degrees C, then the area of application can be further expanded since the substrate is hygienized during decomposition.

PHOTO CAPTION:

This world's largest biogas research plant in Ismaning near Munich supplies energy and fertilizer to an agricultural enterprise. The project was aided by BMFT funds and was carried out by MBB Ottobrunn.

9160
CSO: 3102/292

ELECTRONICS

SEVENTEEN MAKERS OF 64 KBIT RAM'S LISTED

Paris ELECTRONIQUE ACTUALITES in French 2 Apr 82 p 33

[Unsigned article]

[Text] Covering the first quarter of 1982, a Semiconductor Industry Association study listed some 17 manufacturers of 64K dynamic RAM memories; the list does not include companies which produce these components for their own needs, such as IBM or Western Electric.

Reproduced in the attached table, the list is only tentative: according to the association, ITT will enter the 64K market in Europe, and will be the second-largest manufacturer of memories of this size, after Siemens. In the United States, also according to the association, some companies, such as AMD, have deferred their introduction dates while waiting for the formation of a uniform price policy.

The size of 64K RAM chips varies significantly from one manufacturer to another. National Semiconductor, Micron Technology, and Inmos hold the miniaturization record, while Motorola uses a relatively conservative technology with a circuit of nearly 32 square-mm.

The seven major Japanese manufacturers have also adopted large chip sizes, maintaining the 16K-cell design but optimizing marketing techniques. Eliminating the risks inherent in a new design, these companies have bet primarily on market coverage, being capable of rapidly producing the 64K DRAM devices at an industrial rate.

Siemens in turn, has launched a 64K whose chip area reaches 29.6 square-mm; two versions are offered with two different access times (150 or 200 ns), both of them with a redundant bit.

Production of 64K dynamic RAM memories (Semiconductor Industry Association)

Manufacturers	Stage of development	Chip size (square-mm)
AMD	sampling	23.38
Fairchild	sampling	23.86
Fujitsu	production	--
Hitachi	production	--
Inmos	sampling	21.28
Intel	sampling	--
Matsushita	production	--
Micron Technology	production	21.28
Mitsubishi	production	--
Mostek	production	26.44
Motorola	production	32.25
National Semiconductor	sampling	18.70
NEC	production	--
OKI	production	--
Siemens	sampling	29.67
Texas Instruments	production	21.28
Toshiba	production	--

11,023
CSO: 3102/244

RTC SAMPLES ITS FIRST INTEGRATED BIPOLAR MOS

Paris ELECTRONIQUE ACTUALITES in French 2 Apr 82 p 38

[Article by J. P. Della Mussia]

[Text] In May, RTC should begin sampling its first power component, integrating an MOS transistor and a bipolar transistor on the same chip, in a Darlington circuit; this combination was named BIP MOS by Thomson-CSF one year ago.

This device will be able to carry 5 A or 500 V (as Vces and not Vceosus) and switch in 500 ns; the saturation voltage is 2 V with a gate voltage of 10 V. This is first and foremost a test component for RTC. In particular, its chip area, at 25 square-mm, currently corresponds to the best possible compromise for chip area/industrial fabrication yield, but the announced characteristics do not correspond to any particular marketing objective (however, RTC lists the industrial sector, automobiles, audio, and so on, among the possible uses). Maybe users will find interesting applications at the cost of a few current and voltage modifications. No price is presently quoted by RTC. But should an important utilization open up, this price in our opinion could eventually drop to 15 F in a TO 220 package and in large quantities.

Searching for a Compromise

Power MOS devices offer many advantages that bipolar transistors do not have: high input impedance, low switching time, absence of secondary breakdown. But starting with 5 A at 400 V, the MOS requires a large and therefore expensive chip area to reduce the conduction resistance. Moreover, the gate capacity then exceeds 1500 pF, making it difficult to build a control circuit. Hence the idea of combining in a Darlington configuration, a small input MOS and an output bipolar transistor; the MOS contributes its high input impedance, and the bipolar its low cost per switched ampere.

Supertex has already marketed such a completely integrated BIPMOS; Thomson-CSF is offering a hybrid one; and many users create the circuit from discrete devices, an approach which has the advantage of adapting the input and output exactly to the planned application, at a cost which will still remain the most attractive for another one or two years at least.

RTC on the other hand, has perfected in its Caen plant, a device using a D-MOS with 200 pF input capacitance, and a fast bipolar transistor. A 10 ohm resistance integrated between the base and emitter of the output transistor also improves the switching time of the device, as well as its resistance to secondary breakdown.

The BIPMOS voltage rating is specified in Vces. It is indeed known that for a D-MOS, as opposed to a bipolar, the value of Vces and that of Vceosus is the same. Users who want to use this BIPMOS at the Vcesosus voltage will therefore have to wire for a voltage of about only 200 V because of the bipolar transistor (all the values quoted are typical and for 25 degrees C).

RTC has not yet decided which package to use for its BIPMOS. Let us hope it will be a 4-pin model (with the base of the bipolar transistor in the output) so that users will be able to rapidly test this component as a function of their needs.

11,023
CSO: 3102/244

JAPANESE OFFER BRITISH ACCESS TO FIFTH-GENERATION TECHNOLOGY

Paris ZERO UN INFORMATIQUE HEBDO in French 13 Apr 82 p 10

[Article by Rex Malix]

[Text] The Japanese appetite does not seem to be limited to the recent agreements reached between ICL and Fujitsu. In exchange for a participation whose terms are not clearly defined, the British could have access to the results of the very ambitious Japanese program whose goal is to achieve within ten years, performances a hundred times better than those of the Cray 1 (see 01 HEBDO No 689).

What response should the English make to these proposals to participate in the development of fifth-generation computers (proposals that were also made to the French last fall, during a conference in Tokyo)? This is the difficult question that is being raised today.

While the Japanese have not yet actually specified the method of participation in this project, they obviously want to derive great profit from it. The English, whose answer is not yet fully known, did not want to close the doors on all negotiations, and in the meantime are envisaging ways and means to maintain secrecy about research and projects being conducted on strategic points.

Focusing on this topic, a meeting was organized to gather together the majority of chief executives in private and public research centers, the technical directors of the major electronics companies, as well as Robert Wilmot, president of ICL. Another aim of this meeting, was to disclose, as a prologue, the proposals of the Ministry of Industry for improving research in the computer sector.

These proposals amount to an addition of 250 million pounds to the current expenditures for the next five years, and seek to emphasize the effort being made in five specific domains: component integration and the VLSI (very large scale integration) program, networking and local networking in particular, software engineering, artificial intelligence and dedicated systems, and finally, data architecture. These fields were selected for the simple reason that they are areas in which the British have acquired good experience and in which they are relatively advanced.

In England, research institutes traditionally carry out their work as separate entities. Aiming to change this situation, the project proposes to join their research and development efforts, patterning themselves after the method used by the Japanese in centers financed entirely by the government.

Product development should not require financing, and operating costs would be shared by the partner companies. Intended primarily for research, this center would also have commercial interests.

From the beginning of the conference, the participants seemed to agree that the Japanese program was realistic, even if it did not end up ten years from now in the construction of a computer built entirely of VLSI components and a hundred times more powerful than the Cray 1 (see 01 HEBDO No 684).

At the same time, it appeared clear that the Japanese wanted to force the events by staging according to their concept, the probable development of computers in the next ten years, and by laying the foundations of a cooperation in which each participant's role would be clearly defined.

Competition with the Japanese will not be limited to the materials that will be proposed during the next ten years; it is constant and equally covers the products which will be manufactured during the same time period. For the other countries, the only way to remain in the battle consists of formulating a competitive program. A task force composed of the great names in British computers, will study the problem and should offer its conclusions during the next three months.

The 'Cabled' Society

While awaiting the decisions that will be made in this area, the English plan to upgrade their telecommunications infrastructure, and to install in 1983 a new network composed of fiber optics. This should allow each household to receive a 60-channel communications cable.

The government points out that this is the greatest achievement since the railways, telephones, and electricity. Moreover, for electoral reasons, Mrs Thatcher would like to see this operation launched before next year's elections.

The issue has been studied by a consulting committee, whose report should be published in the coming months; it envisages a new market of several billion pounds, which would also generate an intensive economic activity.

The report seems to have been well received by the government, especially since the operation will not require public financing, it being clearly indicated that all the funds will be gathered from private sources. Decisions should be taken about this matter before next autumn.

11,023
CSO: 3102/245

BRIEFS

FRG ENERGY R&D FUNDS--A research program in the field of energy for the 1982-85 period totaling 10.8 billion marks has been approved by the West German authorities. Advanced nuclear research (high-temperature and breeder reactors), as well as coal gasification and liquefaction are part of this program. Funds of DM 1.6 million have been allocated for gasification processes, DM 166 million in the 1982 budget; and DM 572 million for the study of coal liquefaction, 123 million of it in 1982. [Text] [Paris SEMAINE DE L'ENERGIE in French 6 Apr 82 p 10] 9969

FRG ENERGY RESEARCH BUDGET--Bonn--on 24 March the West German cabinet adopted a multiyear energy research program of 10.8 billion marks (4.7 billion dollars) for the 1982-1985 period. Coal gasification and liquefaction and advanced nuclear research figure among the broad directions of the program. Funds of DM 1.6 billion will be devoted to coal gasification during the 4 years in question, DM 166 million of which are in the 1982 budget. DM 572 million are planned for coal liquefaction--DM 123 million for this year. Bonn will devote DM 2.9 billion from 1982 to 1985 to the development of high-temperature and breeder reactors, of which amount DM 701 million are in this year's budget. [Text] [Paris AFP SCIENCES in French 25 Mar 82 p 7] 9969

MORE FUNDS FOR COAL CONVERSION--The highest growth rates in Bonn's outlay for energy research and development through 1985 will be in expenditures for coal conversion, especially coal gasification. This derives from the new energy research program that Federal Research Minister Andreas von Buelow, after numerous delays, is now presenting to the cabinet for ratification. The plan calls for an increase in research expenditures for coal gasification from DM 166 million in 1982 to 672 million in 1985; in comparison, the expenditures for coal liquefaction will only increase from DM 123 million to DM 163 million. The total annual allocations to be provided for coal conversion for 1982 through 1985 are respectively (in millions of DM) 289, 438, 604 and 835. The program proposal is reported to justify the relatively high investments on the basis of industrial and energy policy. Not least, it involves reducing dependence on imports and securing the international position which the FRG has established in this technology of the future. The Federal Government will presumably make its decisions in the second half of 1982 regarding further aid for large-scale coal liquefaction installations. The mechanism of awarding hydrogenation preferences for the operation of such facilities will be tested. At today's prices, the production of a liter of gasoline from German coal would cost about twice as much as a liter from petroleum; hence the necessity for a large subsidy. [Text] [Duesseldorf VDI NACHRICHTEN in German 16 Apr 82 p 42] 9160

ITALY EXHIBITS LATEST IN INDUSTRIAL ROBOTICS SYSTEMS

Paris INDUSTRIES & TECHNIQUES in French 20 Mar 82 pp 7, 10

[Article by Andre Larane: "Robotics: Italy Scores Some Points"]

[Text] Machining Lines for Grenoble and Orleans. Twenty-eight Stations for Angouleme.

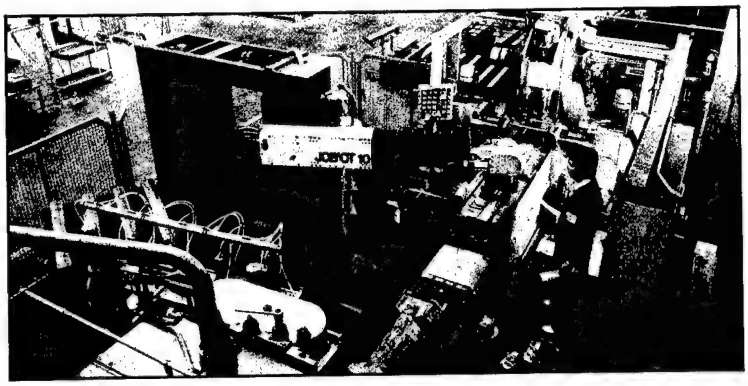
Robots were yesterday's news. The present belongs to flexible shops and automated production cells. At the Fifth NC Industrial Automation & Robot, the multitude of arms with one to six degrees of freedom testifies to the maturity of this sector, which affects painting, welding, and other areas.

With its assembly robot equipped with a Westinghouse camera, Olivetti is very representative of the current research, which is oriented toward fairly rapid shape recognition of jumbled parts. The demonstration of the Italian manufacturer is not convincing because it is restricted to flat objects and requires an 8-second delay for the camera to analyze a part. It goes without saying that the confidential work carried out in laboratories and large firms has gone beyond this stage. After buying 40 Olivetti robots for its own needs, Westinghouse itself is preparing some surprises. At the Polytechnic school of Milan, professors Rovetta and Somalvico are specializing in "seeing."

Doctor Daniele Fabrizi, president of Siri (Italian Company for Industrial Robotics), is astonished at the ferment in the sector. "Once dominated by large groups such as Fiat, robotics is today swarming with small enterprises such as DEA or Speroni, who originally were specialists in measuring machines." But he is very happy about the very rapid entry of his countrymen into the field.

Luciano Torri, technical director of Mandelli, presented the achievements of his company, which manufactures CNC machining centers in Piacenza: before the end of the year, it will inaugurate a machining line for four models of generators at Alsthom-Atlantique Unelec, in Orleans. It will consist of two machining centers with 1200 mm vertical clearance, as well as palletization and control devices (spindle effort and tool life). A multi-spindle lathe, a washing installation, and automatic part feeding will complement this equipment. The installation will be

bles et aux cellules automatisées de production. A la 5e NC Indus- | équipé d'une camera Westinghouse, Olivetti est très repré-



***Robot de manutention** et d'ébavurage pour pièces de carrosserie. 8 axes et une tête de fraisage en option. (Doc. Jobs)*

Maintenance and deburring robot for body parts. Eight axes and an optional milling head. (Documents Jobs)

controlled by a central computer, and only a single operator will be required for supervision. The parts will be measured on the machining centers through statistical sampling, using Renishaw type sensors. An average machining time will be of the order of 20 minutes.

Flexible Machining Line

A second French plant to be equipped by Mandelli will be Caterpillar in Grenoble. It will receive a flexible line with five machining centers with an Over device for head rotation. Thanks to this system, designed in Italy, the spindle works horizontally or vertically, as needed; together with a rotating platform, it machines the five faces of a part.

For its most recent project, Mandelli will equip IBM-Italy in Vimercate, with its new Quasar machining centers. These compact machines with continuous palletization, are in fact designed by flexible shops.

Elsag (Elettronica San Giorgio), in Genoa, specializes exclusively in top of the line numerical control machines and flexible systems. After installing a line of eight machines at Nuova Innocenti, the company is preparing to place 28 stations under the control of a central computer at Leroy-Somer, in Angouleme. The stations, assigned to the fabrication of a very extensive line of engine parts, are already in place; they include machining, lathe, control, maintenance, and even heat treatment stations. A robot also services seven stations and handles parts up 90 kg in weight. The central computer will program the machining as a function of orders, supplies, and priorities. The anticipated result is a better utilization ratio, a reduction of parts in progress, and higher quality.

Among present achievements, are the Maserati plant in Modena, equipped by Olivetti with a line consisting of ten machining centers with automatic transfer. Comau, the Fiat machine-tool subsidiary, boasts of several installations in the automobile and heavy truck industries.

In the shadow of the large manufacturers, the smaller enterprises are consolidating their positions. Jobs, established in Piacenza, offers an eight-axis maintenance robot, to which is attached a small 18,000 rpm milling head. But since the prototype is in operation at a military firm in Varese, the visitors to the Milan exhibits will see only the company's conventional robots. Which leads us to regret that the current Italian and French manufacturers had very few innovations to show.

11,023
CSO: 3102/262

HEAVY ALUMINUM SHEET METAL PLANT HIGHLY AUTOMATED

Paris INDUSTRIES & TECHNIQUES in French 20 Mar 82 pp 25-27

[Article by Jacques Houbart]

[Text] Foundry, rolling, quenching, quality control: all computer operated. Cegedur well deserves to be the second in the world.

The new equipment installed in the last few months by Cegedur-Pechiney at its Issoire plant, doubles the French production capability for aeronautical-specification heavy aluminum sheet. Thanks to its total investment of 100 million francs (in 13 months), the enterprise not only meets the needs of the Airbus and defense, but also those of several industrial sectors enticed by the quality of this new "precision industry."

Aluminum metallurgy has achieved a forward thrust for heavy sheet in the wake of the progress made by industrial computerization. Given the performances of numerical control machines, capable of rapidly and economically shaping thick sheets, designers have been able to abandon the dual system of sheet metal/stiffener for many components, and instead adopt "integral structures" for wing construction.

With the introduction of thick aeronautical sheet, machined parts compose both the outer skin and the internal support structure; the weight of the finished part generally represents 15-20 percent of the weight of the blank. This results in remarkably light, high performance parts.

This technologic evolution began very early in France, in the early 1960's, thanks to the inception of the Concorde program and to the delivery of rough blanks to Dassault for the construction of Mirage's integral structures. After 1975, this was followed by the beginning of the Airbus production, and then by the English-German-Italian plane, the Tornado. The acceptance of thick sheets from Issoire by Boeing took place in 1978.

In 1981, the new heavy sheet metal plant supplied up to 20,000 t/year. Its equipment handles products of much larger dimensions: the unit length went from 15 to 22 m, opening the market for new generation planes. The latest Cegedur investment includes a foundry unit equipped with the latest improvements for liquid metal treatment (melting, maintenance, and casting are entirely computer monitored and controlled); a second drawing bench of 60 meganewtons, in parallel with the

existing 50 meganewtons installation; an totally computerized quenching oven; an annealing oven; an ultrasonic quality control installation; and ancillary maintenance, sawing, and other facilities.

Precision metallurgy means first and foremost the perfect mastery of the the basic material, and the history of thick sheet-metal in France owes a large debt to the Voreppe Research Center which supports the Central Testing Laboratory of Issoire, using every opportunity for progress expected by aircraft manufacturers. Among the most recent developments are the 7050, 7010, and 7475 alloys, which guarantee high strength together with good mechanical characteristics. Special heat treatment processes applied to the 7000-alloy family improve their specifications.

Perfect mastery of stress, fatigue, and stress corrosion resistance while using the least amount of material possible (lower safety coefficient), demands an accurate knowledge of all aspects of the metal's properties. This imposes a rigorous control at all stages of the metal's formulation and processing, so as to achieve a homogeneous structure with perfectly defined characteristics.

Assuring Conformity with Standards: the Laboratory Breaks 500-600 Samples per Day

Batch composition must be perfectly monitored and reproducible when the alloy is formulated. After melting, when the aluminum and additive elements are mixed, all foreign bodies (gases, oxides) must be eliminated from the liquid bath. That is why the new foundry unit is equipped with the latest improvements in liquid metal treatment. At the time of casting (semi-continuous technique), the metal is again carefully filtered, with the various operations being monitored by computer. The casting is spectrographically analyzed to verify if the alloy composition conforms to the standard's definitions.

To achieve a homogeneous structure throughout the thickness of the plate (same structure at the surface as in the center), the metal is hot-rolled using a reversible mill with a table width of 3.40 m, driven by a 15,600 hp motor. Computerization assures remarkable conditions of planning, reliability, and speed. Milling temperature, which is extremely important in determining product quality, is monitored with particular care. At this point, each plate is assigned a number, like an original printer's edition. This identification makes it possible to trace its fabrication history, even at the application stage. During high precision heat treatments (plus or minus 2 degrees C), the plate temperature is monitored with thermocouples located at the hot and cold points of each quench.

To eliminate the internal stresses created by the quench, stresses which could cause deformations during the machining of parts, each plate is drawn on 5000 and 6100 ton benches, which places them among the highest performance equipment operating in the world. The residual elongation of each plate is then carefully measured. Automatic ultrasonic-immersion quality control installations--60 and 210 square-meter tanks for plates of 3200 x 22,000 mm--are then used to examine the internal soundness of the sheets; any existing defects are shown at one-tenth scale on a recording. Each automatically detected defect is next evaluated more precisely through manual control by comparing it with AECMA standard normalized defects. The entire thickness of the product is probed, except for two "dead zones" of 3 mm per face. In addition, a surface "conductivity" test (sygma-test) verifies the homogeneity of the quench.

In order to improve the mechanical properties of some alloys, increase their stress-corrosion resistance, or strengthen them, a hardening treatment (up to 45 h) is sometimes applied and is controlled with the same precision as the formulation of solutions. Before delivery, the mechanical pull characteristics of the products are measured to assure conformity with receiving inspection standards. The Issoire laboratory thus breaks 500-600 samples per day.

Surfacing is then necessary in order for the user of thick sheets to be able to perform high-precision NC machining. This consists in removing from each face, a layer of metal corresponding to the zone which was by-passed by the ultrasonic control, while operating within very close tolerances (5-20 hundredths mm). The task requires patience and minute attention. At Issoire there are only six technicians practicing this specialty, which falls midway between initial processing and the finished product.

Aeronautics metallurgy is stimulating other industrial sectors which require materials with higher performance. That is how for example, Fortal HR supplied in thick sheets (aluminum, zinc, magnesium, copper) is expanding the aluminum market. In some applications (such as stamping) it results in machining time savings of 50 percent.

Applications in Pressure Vessels, Naval and Railway Construction

In Limoges, at Legrand, world leader in the fabrication of electrical installation equipment, Fortal HR is used notably in stamping; but this product is suitable for bending equipment, some coining, and injection molds. Thick sheets from the aeronautic industry are also increasingly used for pressure vessels, or in naval and railway construction, for industrial vehicles, and in the weapons industry.

However, it is not impossible that in its original sector--aeronautics--thick aluminum sheets will have a second spurt despite the development of composites: it seems that the size race for cargo and passenger planes has already started. Boeing is studying the design of a twin-fuselage plane weighing 1600 tons, with a wingspan of 160 m, and powered by 12 turbojets. Its first application could be the transportation of liquefied natural gas from Alaska. Dornier is also studying a 1000 t plane, with a wingspan of 100 m, equipped with 10 turbojets and capable of transporting 400 t at 800 km/h. What is certain in any case, is that the battle for the skies in the year 2000 will be a battle in which aluminum will play its part, but will probably not risk its existence.

CAPTIONS

The 3.4-meter wide reversible rolling mill is driven by a 15,600 hp motor. The bold advance in thick sheets was made possible by the progress in industrial computers. Production is 20,000 t/year. (Documents Cegedur-Pechiney)

The vertical quenching oven. The temperature is controlled to plus or minus 2 degrees C.

Drawing bench with a power of 6000 tons. This traction is intended to eliminate the internal stresses due to quenching, which could cause deformations.

Hot and cold points are monitored by thermocouples before placement on the bench.

Ultrasonic quality control tanks. Some accommodate sheets of 3 m x 22 m. The automatic control is designed to detect internal defects following drawing.

Ultrasonic quality control: a recording shows possible defects.

Flatness verification of a surfaced sheet. The product quality is attractive to other industrial sectors which require high performance materials.

Conductivity measurement to verify quench homogeneity.

The plate is numbered. The history of its fabrication can be retraced.

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RENAULT PUTS FIRST FLEXIBLE WORKSHOP INTO OPERATION

Production Line

Paris LE MONDE in French 7 May 82 p 30

[Article by LE MONDE special correspondent Veronique Maurus]

> [Text] Boutheon--On Monday 3 May in Andrezieux-Boutheon (Loire), Labor Minister Jean Auroux inaugurated a flexible workshop for machining gearbox housings; according to the Renault group, this represents a French, and even a world, "first." In fact, the workshop covering an area of 3,000 square meters, is operated in real time by a computer which, being in constant contact with the machines, continuously provides for optimal production costs. It simultaneously handles the four pieces which make up the new B-19 gearbox now being supplied by Renault Industrial Vehicles [RVI]. This gearbox will be used in all of the group's topline vehicles, replacing the gearboxes hitherto purchased in part from foreign manufacturers. This workshop is being made a part of the RVI de Boutheon plant, which employs 570 wage earners and manufactures about 100 gearboxes per day.

The Boutheon plant is the usual type, modern without going to excess. It is a large machine shop with rough walls, under a light framework, not very well lighted or very clean, cluttered with tote boxes, cables, and pulley blocks. A few meters away, we have another world. New flooring, lighting, walls painted with frescoes; all this counts for a lot. But that is not all. With one step we have crossed the threshold of a century. No more plant, no more workshop; more a sort of mockup like an enormous toy, halfway between an erector set and an electric train.

Perched in a glass-lined cabin, insulated from noise and heat, man and computer control a group of discreet, well-dress automatons: seven machines[1], protected by a hood to prevent any spattering of water or oil, machine, drill, and bore out the pieces, each at its own rhythm, without human intervention. Eight dollies circulate among the machines, obviously self-propelled, guided by invisible wires whose network, one can guess, is

underground. The dollies bring the rough pieces to the entrance of the shop, transport them from work station to work station, and then, when the machining is completed, bring the finished piece to the end of the line. All that is done without noise, while respecting, traffic permitting, subtle rules of priority dictated by an electronic brain, and going so far as to change an old battery for a new one when the old one is used up. With their load, the dollies weigh 3 tons each; one would say they are "Lego."

Four different pieces--gearbox housings for very large vehicles--are machined in this workshop at the same time. The "intelligent" machines recognize the model and adapt their tools immediately. The computer controls everything: it distributes the workload among the various machines, alters their programs, arranges priorities and, in short, renders production costs optimal every moment. In case of a breakdown, it isolates the defective machine for the time necessary to make repairs, so that the work continues, more slowly but without stopping. When a new piece is introduced, 4 hours are sufficient to adapt the entire workshop (whereas, with the conventional system, at least 80 hours are needed to change a manufacturing line). No excess stock, no break in the rhythm, everything done is real time. Only two men in blue load and unload the dollies according to indications which the computer records on their printout. Ohters inspect, regulate, and repair as necessary; one scarcely sees them. There are a total of 15 persons in two shifts for a current daily production of 25 housings, 40 per day by the end of the year, 70 when the line is in full swing, and 100 forecast for 1985 (with 20 persons).

Designed and built by and for the Renault group[2], is the Boutheon flexible workshop really a "world first," a "true French flexible workshop first," as the company asserts?

An Event

It is surely the most sophisticated automated production system of the Hexagon, the only one to be operated in real time by a computer and to function in this manner in such an aggressive environment (projections are normally quite substantial). The first in the world? Let us not quibble. In any case, in the Renault group and in the small world of French robot operations, it is an event.

According to the director, this workshop represents for Renault Machine Tool [RMO], "the first tangible expression of a strategy" (see second article), a fabulous showcase and a laboratory of true grandeur. For RVI it has been at least a gamble for 2 1/2 years. Having "no alternative other than to raise itself to the highest level of international competition," according to M Zanotti, its president and general manager, in order to attempt the difficult recapture of a domestic market which had fallen to the 1965 level, and, if possible, to find new outlets abroad, RVI had to invest in new machining methods while being "sure that the technology chosen would still be valid in 2000." To manufacture the four types of housing at the required productivity level, the group had a choise, once the highly inefficient conventional machines were eliminated, between two alternatives: either to

install four different production lines equipped with sophisticated robots but designed to handle a particular type of piece, or to develop a single robotized production line capable of handling the four different pieces upon demand. The latter solution won out because of its flexibility, but not without reservations and misgivings. "I risked being without a gearbox," M Zanotti admitted, expressing relief.

Two and one-half years later, however, the gamble seems about to pay off. For a tie-up of funds equal to that of a conventional system[3]--savings realized on the stocking of parts would offset the excessive cost of equipment--the Boutheon workshop enables RVI at any moment not only to adapt its production to the demand, any adjustments for going from one reference to another being eliminated, but also, over the longer term, to modify the machined product without involving the tooling--that is, to introduce completely new pieces, the only condition being that they fit into a cube having 60 cm on each side.

Equivalent Number of Employees

As for the number of employees, that is another matter. In theory the flexible workshop permits an appreciable manpower savings (a single line instead of four). In fact, RVI asserts, the number of employees is the same as that of the strictly conventional system, due to the increased need for maintenance personnel. Moreover, the introduction of a flexible workshop requires increased skill among the workers, enriches their work, and improves the quality of the product by eliminating repetitive or irksome tasks. Under the circumstances, the establishment of the Boutheon plant has made it possible to create 15 jobs, 9 of which are highly skilled requiring a total of 10,000 hours of training, or an average of 4 full months per person. It should be pointed out that the machining time for one piece is reduced to 1 hour, compared with 6 in the conventional system.

Contested? Apparently not, or at least not yet. Stressing the "national importance of this accomplishment," the secretary (CGT [General Confederation of Labor]) of the RVI Central Committee for Enterprises, who was invited to the inauguration, rightly expressed regret that the workshop has not yet been presented to the shop personnel as a whole (570 employees), emphasizing the dangers of a rejection by nontrained workers compared with younger workers, and the mastering of new techniques. Also present, the minister of labor in turn did not hesitate to praise the merits of the intelligent machine: "Yes to the machine" and, to Renault: "You are showing the way." Alas! For, according to M Zanotti, although there is only one workshop of this type in France, there are already 9 in Sweden, 9 in the FRG, 25 in the United States, and 40 in Japan.

FOOTNOTES

1. Four machining centers, two convertible modular machines, interchangeable, and a boring and truing-up machine.

2. RMO designed and built the workshop; 65 percent of the equipment was supplied by the Renault group, specifically RVI, which manufactures all the gearboxes for its heavy vehicles at the Boutheon plant.

3. To manufacture its new gearbox, RVI plans to invest a total of 300 million francs at its Boutheon facility; 125 million have already been committed, and 45 million are just for the flexible workshop.

Market for Technology

Paris LE MONDE in French 7 May 82 p 30

[Article by R. C.]

[Text] For nearly 10 years, Renault has been developing an all-round strategy in the area of automation. Machine tools, robots, self-driven dollies, measuring machines, programmable automatons, inventiveness, basic and applied research, training by its subsidiary, RMO, the Regie [Renault state-owned works] "is clearly expressing its aspirations in this future domain." Contacts have already been made for the construction of flexible workshops of the Boutheon type with Messier-Hispano-Bugatti and Caterpillar.

Will the Regie profit from its presence in the American market to export this technology, as it has done in the case of robots, by establishing a subsidiary with the American-owned Ransburg (Cybotech)? The agreements with Mack and Dodge could help it in that respect. But Renault prefers to wait: "We are not contemplating getting going in the United States," an RMO executive comments. "Our agreements deal with products, not equipment. Moreover, this type of shop involves special machines [that are] very difficult to sell 6,000 km from our base of operations. For example, Japan exports mainly standard machines right out of the catalogue, not this kind of equipment." According to Renault, this type of workshop is adapted to small and medium production runs in the sector of mechanical construction (trucks, agricultural machinery) and electrical construction. Theoretically, it is also adapted to the PMI [small and medium-size industries]--particularly in its light version, the flexible unit. But few companies have the means to acquire such equipment, either from the financial standpoint or from that of the technical capability to master this advanced technology.

8568
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SCIENCE POLICY

RESEARCH BILL APPROVED BY COUNCIL OF MINISTERS

Paris AFP SCIENCES in French 25 Mar 82 p 7

[Article: "Policies and Organization of Scientific Research"]

[Text] Paris--An official communique published after the Council of Ministers meeting on 31 March announces that the Minister of State for Scientific Research and Technology has presented a bill for the orientation and planning of technological research and development in France, prepared after broad consultation with researchers, unions, and economic leaders, and after having been submitted for review by the Economic and Social Council.

"The major objective of the bill, which includes the text of a law and an appended report that is also submitted for parliamentary approval, is to bring expenditures for internal research and development to 2.5 percent of the GNP in 1985. This effort will take the specific form of multiyear mobilization programs on themes of national interest associating multiple partners."

"The law provides that the legal status for research personnel may depart from the general status for government employees in order to allow the recruitment of experienced French or foreign researchers or engineers, to improve the methods for evaluating qualifications, and to facilitate the free movement of men and teams among [public] organizations, firms, specifically public ones, and establishments of higher education."

"A new category of public establishments of a scientific and technical nature will be created. Public interest groups with a specified duration will constitute a powerful and original means of achieving actions associating various public and private partners. The regional dimension of research will be taken into account."

The Ministry of Scientific Research emphasizes that while the bill itself defines, in 26 articles, the provisions of a legislative nature, the appended report "describes policy" and the broad programs projected, and constitutes "a document which has the force of a plan."

It is estimated by the ministry that the bill and the appended report should go to Parliament during the first half of May.

9969
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SCIENCE POLICY

FRENCH CIVIL R&D BUDGET TO INCREASE DRASTICALLY

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 14 May 82 p 7

[Article: "France Beefs-Up Research Support: Space Technology an Area of Emphasis"]

[Text] Frankfurt, 13 May--Expenditures by the French Government for civil research will be drastically increased in 1982 in line with the thinking of the new government. Compared to 1981 figures, expenditures will be increased by 29 percent to F 25.4 billion. Three-fourths of the budget--F 20 billion--goes to the research ministry; the remaining funds will be distributed to various other ministries. A specific outcome of this is the creation of 1,580 new positions for scientists and engineers this year. In addition to financing current budgets for research institutions, the research ministry will administer nine research programs which together will spend F 9.1 billion. The budgets for the main categories in millions of French francs are:

Nuclear research program	3,395.0
Space technology	1,746.0
Sea technology	60.0
Solar energy	100.0
Anvar (risk capital business and innovation support)	827.3
General innovation support	90.0
Information theory	167.5
Data processing, communications	658.3
Aeronautical research and engineering	2,080.0

In the area of nuclear research and engineering, the light-water reactor continues to be the center of interest, especially with respect to safety research and uranium enrichment. In space applications, the most important

program is the Ariane booster rocket which is being developed under French program management. In supporting innovation, the French Government operates through the government corporation Anvar which shares the risk of worthy programs and also gives concrete aid in specific cases involving the application of research results. A specific item is aeronautical research support which currently includes the Airbus A 320 program and other aircraft developments.

In addition to these programs which total F 9.1 billion, there is still the support of institutions--handled the same as in Germany--which will require F 12.73 billion. Primary institutions in this category are the CNRS and the French Atomic Energy Agency. If the F 3.2 billion expenditure for institutional support of French atomic research administered by the Atomic Energy Agency is added to the line-item program allocations of F 3.4 billion, then the French Government will expend about F 6.6 billion for nuclear research and engineering in 1982. A categorical comparison with German institutional funding is not possible since the scope of activities of the individual institutions is quite different.

9160
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EUROPEAN AIRCRAFT INDUSTRY IS BASED ON COOPERATIVE NETWORK

Duesseldorf VDI NACHRICHTEN in German 16 Apr 82 pp 26-27

[Article by Erhard Heckmann: "Programs Bind the Enterprises — The Aviation Industry Is A Network of Cooperation"]

[Text] The British aviation industry was the only one still intact in Western Europe after 1945. All other countries had to rebuild their aircraft industries. To this end they sought experienced foreign partners. In the beginning the United States was the partner with licenses and new technology but the cooperating Europeans have strongly caught up and become competitors (see also "The European Aviation Industry" in VDI NACHRICHTEN Nr 10/82).

Until the end of World War II aviation industry cooperation was limited to simple license contracts but genuine cooperation of the most varied form developed in the postwar period. There were several reasons for this. Only the British aviation industry among the western European countries survived the end of the war intact. The other industrial nations had to completely rebuild their aircraft industries. Another reason was that the products themselves, the aircraft, became technically far more demanding. Because of jet engines, aircraft could achieve higher speed ranges and became considerably more reliable and capable because of new types of navigation equipment, new aircraft control technologies, new means of construction and greater capacities. Transport capacity increased enormously. Thus a Boeing 707 or Douglas DC-8 surpassed the capacity in transport of the largest and fastest passenger ship. The influence of the equipment industry increased on both performance and construction costs. In short, aircraft also became more expensive — according to a Boeing formula, 7 percent per year due to new technology alone. This also increased the risk for the manufacturer. For this reason the attempt was made to shift the technical [risk], and thereby the economic, to several partners through cooperation. The same applied to the military sector. The Messerschmitt Me109 cost only 135,000 Reich marks [but] the Starfighter ran to DM 6 million and the Tornado about 30 million. Another reason for cooperation is found in offset agreements under the principle "if my company/air force is to buy your aircraft, you must give corresponding orders to my industry so that my plants can learn the new production technologies and also to preserve my currency reserves." This method is used today to sell not only Boeings and Airbuses but also Mirages, F-16s, F-18s and, not least of all, the NATO AWACS early warning system.

This brings one to a basic economic problem. The industrial state may be defined as one whose industry is technically capable of meeting domestic and export requirements in all areas. Strictly speaking, this would mean that only the two world powers are genuine industrial states. We cannot build aircraft carriers or nuclear submarines in Germany. The rule is thus somewhat bent. But Switzerland stopped domestic development of combat aircraft at the end of the 1950's and virtually the same applies to Canada.

Since the aviation industry is viewed as a pioneer industry which radiates technical impulses to the rest of the economy and helps it to raise the level of technology, a waiver here — often dictated by economics — also means decoupling from new technologies. But these new technologies are the result of extreme requirements and the developments proceeding from them. So as to at least not sever the connection to modern production technology, since today's production is yesterday's development, a transfer of this know-how is demanded.

Whereas in the case of military aircraft the customer, that is, the government, always paid for development and production, civil aircraft were formerly financed by industry. It was a matter of course that industry formerly could not pay for new developments from its back orders since it functions, just like the rest of the industrial economy, with bank credits. Only where the technical and business risk was unacceptable to industry did the state assist with lost subsidies, conditionally repayable loans, sureties and sales assistance. But the capabilities of individual countries are limited by their budgets. International cooperation or international work sharing offered a solution since the parliaments, which had to approve the necessary funds, gave international cooperation an almost moral value. In such cases industrial cooperation contracts are backed up by parallel governmental treaties. Such forms of cooperation are not limited to aircraft but also apply to engines and important equipment systems.

It is characteristic that these international connections range extensively through the firms. There are virtually no competitive situations between the enterprises. Competition is limited to subsectors although, as in real life, there are also enterprises which feel themselves to be more closely connected than others.

Genuine international division of labor developed first in the postwar years and is still in a state of flux. It began with the cooperation of German and French and French and British firms and has now reached worldwide proportions. It includes both the Japanese and the young Indonesian aircraft industry. It ranges from Argentina to Sweden.

The forms of international cooperation differ. The division of labor in development cooperation corresponds to the depth of financial [involvement]. Joint development teams can be used but also separate ones when the sectors can be clearly separated. Examples here are the Tornado, Airbus, Alpha Jet. In the subsequent production each state will emphasize its own final assembly because this facilitates experience feedback in the operational phase. In the case of Airbus, a single final assembly was selected for cost reasons since the price plays a prominent role in a civil project.

Many Forms Support Cooperation

In coproduction the development firm has already produced the production documents and possibly even already produced. In another part of the world a production consortium with clearly defined construction division and one or more final assembly lines is formed. The F-16 is an example.

License production is pure copying with the licenser initially furnishing the licensee knock-down sets which are disassembled aircraft consisting of a few main components. These are then assembled, checked and test flown with the [licensee] gradually assuming a greater depth of production. Examples: F-5E/F production in Switzerland and Bo 105 production by Nurtanio in Indonesia.

A further form is compensation to, as the capabilities of the receiving country allow, as far as a balance of payments with the deliveries being in part in foodstuffs (Romania) or in part in industrial goods. The not least important reason for cooperation agreements is also the availability of free capacities. This applies in particular to capital-intensive areas of tension.

License production was the foundation for the rebuilding of the German aviation industry after the war. If the initial NASH list of equipment is ignored, the so-called first generation of aircraft included the license construction by Focke-Wulf of the Piaggio 149 as a training aircraft, the Nord Aviation Noratlas [built] by the Nordgruppe Weser-Flugzeugbau and Hamburger Flugzeugbau, the Fouga Magister [built] by Flugzeug-Union-Sued. In F-104G Starfighter production the bilateral license agreements were replaced by a multination license consortium in which the aviation industries of Germany, Italy, Belgium and Holland were represented. This was quickly followed by the Transall program with Aerospatiale, VFW and MBB (HFB) and the Atlantic with Dassault Breguet and Dornier. Construction programs in which at least three NATO members participated were designated NATO programs. It is of advantage to the licensee when he receives the status of a development custodian during the use phase. He then assumes design responsibility for changes and improvements.

The next — and a higher — form of cooperation is joint development such as with the Tornado and Alpha Jet. Very differing organizational forms are used in the management of joint development and construction programs. They range from a working group to institutionalized forms. A few should be mentioned here.

Sepecat was established by Dassault and the British Aircraft Corporation (now British Aerospace) for development and construction of the Jaguar combat aircraft. The Airbus Industrie is a "Groupement d'Interet Economique" under French law with the participants being Aerospatiale (37.9 percent), Deutsche Airbus (37.9 percent), British Aerospace (20 percent) and the Spanish Casa (4.2 percent). Panavia GmbH with shares held by British Aerospace (42.5 percent), MBB (42.5 percent) and Aeritalia (15 percent) is registered in Munich under German law. The Turbo-Union Ltd for development and construction of the Tornado RB.199 engine is registered in England. Its shareholders are Rolls-Royce (40 percent), MTU (40 percent) and Fiat Aviazone (20 percent). The firms of Aerospatiale, MBB and VFW belong to the Transall Working Group.

CFM International SA to develop a 10-ton engine is held equally by General Electric and Snecma, the [project goal] having been achieved with the CFM56. Rolls-Royce Turbomeca Limited to develop and produce the Ardour engine for the Jaguar fighter-bomber is registered in London.

The following list will show how and with which programs the individual firms are interconnected.

/Federal Republic of Germany/. Dornier. Alpha Jet close air support aircraft: development and production jointly with Dassault Breguet, components production by Sabca in Belgium, license production by AIO in Egypt. AWACS early warning aircraft: subcontractor to Boeing for mission electronics integration. IA-63 light fighter: advise and support to the Argentine FMA.

MBB. Tornado multirole combat aircraft: joint development and production within the Panavia framework together with British Aerospace and Aeritalia. Transall transport aircraft: production of a new lot together with VFW and Aerospatiale for the French and Indonesian air forces. Airbus A-300 and A-310 passenger aircraft: development and production participation under an Airbus Industrie contract jointly with Aerospatiale, British Aerospace, VFW and Casa. F-28 passenger aircraft: parts production for Fokker. Bo 105 helicopter: joint production with Casa for the Spanish Bo 105, license production at Nuritano in Indonesia.

VFW-MBB. BK 117 helicopter: joint development with Kawasaki. Tornado multirole combat aircraft: participation in construction of fuselage center section. Transall transport aircraft: components production. Airbus A-300 passenger aircraft: participation in construction, reequipping to cargo version, share in A-310 production. F-27 passenger aircraft: components production for Fokker.

MTU. RB.199 (Tornado engine): development and production within the Turbo-Union framework together with Rolls-Royce and Fiat (MTU share: 40 percent). Tyne turboprop: joint production of a new series of 150 engines together with Rolls-Royce, Snecma and FN (MTU share: 28 percent). Larzac (Alpha Jet engine): production under KHD subcontract together with Turbomeca and Snecma (MTU share: 25 percent). Pratt & Whitney 2037: joint development with Pratt & Whitney and Fiat (MTU share: 11.2 percent). MTM 385 helicopter turbine: joint development with Turbomeca (MTU share: 50 percent). Allison 250: license production for Bo 105 helicopter (MTU share: 40 percent). General Electric CF6: production of high pressure turbine for Airbus engines together with Snecma and GE (MTU share: 10 percent). Pratt & Whitney JT8D: license production of turbine parts.

/Belgium/. Sabca. F-16 tactical fighter: final assembly and test flying of aircraft for Denmark and Belgium, coproduction with Sonaca, General Dynamics, Fokker and others. Alpha Jet: production of forward fuselage sections for Dornier and Dassault Breguet. Mirage F1 fighter: production of vertical and horizontal tail assemblies. Boeing 737: furnishing hydraulic final control elements.

Sonaca. F-16: airframe assembly and components manufacture for European-American coproduction. Mirage fighter: components manufacture. Lockheed C-141 transport: manufacture of fuselage skin components. Aerospatiale helicopter: manufacture of airframe components.

FN. F-16 F100 engine: production under U.S. Air Force contract. Tyne: license manufacture for new series together with Rolls-Royce, Snecma and MTU. CFM-56: development production. Larzac: components manufacture.

/Great Britain/. BAe. Harrier vertical takeoff aircraft: licensed to McDonnel Douglas in the United States, further development to AV-8B by MDD with BAe as subcontractor. Hawk trainer: development and manufacture, license assembly by Valmet in Finland, further development of Hawk to Navy trainer by McDonnel Douglas in the United States. Jaguar fighter-bomber: development and production together with Dassault Breguet within the Sepecat framework. Tornado multirole combat aircraft: development and production together with MBB and Aeritalia, development of air defense version. BAC 111: license manufacture in Romania. Airbus A-300 passenger aircraft: manufacture of wings, A-310 wing design, member of Airbus Industrie. BAe 146 feeder aircraft: development and manufacture, components manufacture by Shorts, Saab and AVCO (wings) in the United States.

Shorts: components manufacture for BAe 146, F-28 and Boeing 757.

Westland. Gazelle helicopter: joint British-French program from 1967/68, managed by Aerospatiale. Puma helicopter: same as with Gazelle. Lynx helicopter: derived from British-French program, managed by Westland. SH-3 Sea King helicopter for navy: further development of Sikorsky (S-61) license. EH-101: joint development with Augusta of Sea King followon.

Rolls-Royce. RB.199: development and production in Turbo-Union framework together with MTU and Fiat. Gnome: license manufacture and further development of General Electric T58. Adour: development and production of this Jaguar and Hawk engine together with Turbomeca. Pegasus: further development and production, planned license production in United States by Allison. Spey: development and production, American license production by Allison, planned license manufacture by Fiat for AMX. Viper: license production in Yugoslavia. Tyne: license production by MTU, Snecma, Fiat. GEM helicopter engines: RJ500 components manufacture by Turbomeca, joint development with Japanese firms IHI, KHI and MHI.

/France/. Aerospatiale. Mirage: components manufacture for Dassault Breguet. Airbus A300: development and manufacture within Airbus Industrie framework, final assembly in Toulouse. Airbus 310: development and manufacture within Airbus Industrie framework, final assembly in Toulouse. Airbus 320: development and manufacture within Airbus Industrie framework, final assembly very likely to be in Toulouse. Transall: prime contractor for new lot, manufacture jointly with MBB. ATR-42: joint development with Aeritalia. Gazelle helicopter: joint program with Westland, managed by Aerospatiale. Puma helicopter: joint program with Westland, managed by Aerospatiale, license production in Indonesia. Lynx helicopter: joint program with Westland, managed by Westland.

Dassault. Alpha Jet: development and manufacture jointly with Dornier, license production in Egypt by A.I.O. Jaguar: development and manufacture with British Aerospace in Sepecat framework. Mirage: development and production, components manufacture by Sabca, Sonaca, Aerospatiale and Casa. F-27: components manufacture for Fokker.

Snecma. Larzac 04 Alpha Jet engine: production jointly with Turbomeca, KHD and MTU. General Electric CF6-50, CF6-80A1 and CF6-80C: manufacturing participation together with MTU. Rolls-Royce Tyne: manufacture of new lot for Transall together with Rolls-Royce, MTU and FN.

CFM: joint General Electric and Snecma subsidiary to develop and produce the CFM56 10-ton engine.

/Italy/. Aeritalia. Tornado: development and production in Panavia framework together with MBB and British Aerospace, production of wings. G.222 transport aircraft: development and manufacture, components manufacture by HAI in Greece. AMX combat aircraft: development together with Aermacchi and Embraer in Brazil (30 percent). ATR-42 feeder aircraft: development together with Aerospatiale. Boeing 767: participation at own financial risk, production ailerons. Components manufacture for McDonnel Douglas DC-9-80, DC-10, Boeing 747SP and 727.

Aermacchi. AMX combat aircraft: development jointly with Aeritalia and Embraer. Boeing 767: participation in development. MB.326 trainer: license production in South Africa and Brazil (Embraer).

Augusta. Sikorsky S-61: license production following termination of production in the United States. Bell helicopters: license production of 204, 205, 206, 212, 412. Hughes helicopters: license production of types 300 and 500. Boeing-Vertol Chinook: license production. EH-101: joint development of Sea King followon with Westland in framework of European Helicopter Industries.

/Holland/. Fokker. F-16 combat aircraft: European coproduction, final assembly. F-27 Friendship: development and production, components manufacture by MBB, Sabca and Dassault. F-28 Fellowship: development and production, components manufacture by MBB and Shorts. Airbus A-300 and A-310: components manufacture. MDF-100 passenger aircraft: development jointly with McDonnel Douglas.

/Sweden/. Saab. 340 feeder aircraft: development with 30 percent participation by Fairchild (United States). BAe 146 feeder aircraft: components manufacture at own risk. McDonnel Douglas DC-9-80 passenger aircraft: components manufacture.

Volvo. Pratt & Whitney JT8D: further development and afterburner development to RM8A and RM8B. TFE1042: development based on Garrett TFE731. General Electric 404: 40 percent license production planned.

/Switzerland/. Emmen Aircraft Plant: final assembly of F-5E/F with deliveries from Pilatus and FWA.

/Spain/. Casa. Airbus A-300: components manufacture. Airbus A-310: development participation as partner in Airbus Industrie. Mirage: components manufacture. 212 Aviocar small transport: license production by Nurtanio in Indonesia. CN 235 small transport: joint development with Nurtanio.

It must also be noted that financial interconnections exist between several aviation firms. Dassault and Fokker are the owners of the Belgian Sabca which holds 4.9 percent of Sonaca. Northrop has shares in the Dutch firm of Fokker. This American enterprise also owns part of Casa, the other foreign shareholder of which is MBB.

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DIESEL ENGINE FOR PEUGEOT VERA EXHIBITED AT GENEVA

Paris INDUSTRIES & TECHNIQUES in French 20 Mar 82 p 10

[Article by JLT]

[Text] Starring at the Geneva Salon, the Peugeot Vera Supercharged Diesel

A new stage for Peugeot in the economy race: after Vera, the result of its materials research, the company has concentrated its efforts on engines, and at the Geneva Salon presented the prototype Vera 02 Diesel.

The agreement with the Agency for Energy Savings covered the development of a specific diesel engine, in keeping with the philosophy of a gasoline prototype. The results are remarkable: 3.5 l per 100 km at 90 km/h, 5 l at 120 km/h, and 5.2 l in city driving. Its performance is equally as good: 35.3 s for 1000 m from a standing start, and a top speed of 158 km/h. To achieve these figures, the basic engine selected by Peugeot has been the 1360 cubic-cm XY gas model which is used in the 104 and the Samba. It is supercharged to obtain sufficient power and torque.

Aluminum Alloy Pistons

Its various components are: aluminum alloy block and head, the former with cast iron insert sleeves, the latter with eight in-line valves with overhead cam; and a turbulence pre-chamber of the Ricardo Comet V type. To withstand combustion pressures of 120 bar, the special pistons are made of aluminum alloy with cast iron inserts, the connecting rods of nitrided forged steel, and the crankshaft of forged steel with damper pulley. The Bosch injection pump is equipped with a flow corrector controlled by the supercharge pressure. The latter is provided by a small KKK turbocompressor, specially designed to maintain acceptable pressures throughout the engine's operating range. Moreover, the poor efficiency of the turbocompressor at low engine speeds is compensated by an advance in the closing of the intake valve, and by the adoption of a 21.8 volumetric ratio. In terms of specific consumptions, the best efficiency range (185-195 g/hp.h) corresponds to normal utilization engine speeds.

The installation of a diesel engine has required several modifications of the vehicle. Sound and vibration insulation were enhanced by lining the hood and the plastic floorboard, by screening in the engine compartment, by a swivel joint on the turbocompressor exhaust, and by a torsion flap on the intake manifold to reduce the denture-rattle at idling. Lightweight equipment such as a cadmium-nickel battery were selected to compensate for the additional weight inherent in diesel engines. The diesel version is 53 kg heavier than the Vera.

"The approaches selected for the Vera 02 Diesel are all the more interesting for being appropriate for industrial production," as Peugeot points out. In fact, with the flat windscreen hubcaps and the sealed windows and headlights, the research spinoffs are already affecting the current models. On the new 505 station wagon, a 2 mm overhang on the rear of the roof causes a slight airstream break and improves aerodynamics.

And what is Renault doing in the meantime? It currently remains very discreet about the Eve Plus program, which focuses on three goals: an electronically-controlled automatic transmission with five distinct ratios, an energy-recovery device for the brake system, and most importantly, a direct-injection diesel engine.

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METHANOL ENGINE UNDER DEVELOPMENT IN FRANCE

Paris INDUSTRIES & TECHNIQUES in French 20 Mar 82 pp 100-101

[Article by A.-M. Despradelles]

[Text] Descended from earlier motorcycle competitions, this methanol engine is powerful, responsive, and reliable.

The search for the miracle fuel that would replace gasoline or diesel fuel for thermal engines, is a challenge which has spawned many inventions since 1973. Some of them--remember the water-powered engine--have known a passing moment of glory thanks to the media, but very few have succeeded in reaching the industrial production stage.

Yet that is the case of the Moteurgaro, being built today by the Chenesseau company in Orleans. The first thing in its favor is the choice of methanol, which is known to have the best chances of becoming the fuel of the future, and which is the object of many research programs throughout the world. The second, is an inventor who can draw on some 30 years of experiments and tests.

Roger Agache, mechanical engineer, in fact won the Bol d'Or motorcycle competition on several occasions during the 1950's, and at the time had perfected a four-cycle engine with an in-head rotary distributor instead of valves. Moreover, he also won the "free fuel" races, having already opted for methanol, which gave him the decisive advantage of a better thermal yield.

The Suez events of 1956 encouraged him in his research, and the oil crisis of 1973 confirmed his belief that he had chosen the right path. He pulled out his files, and renewed his contacts, particularly with PCUK in Villiers-Saint-Paul, which promised to supply him, at no cost, with all the methanol that he might need for his tests. In 1974 he filed a patent application, and in 1975 two modified cars were burning methanol. One of them has already accumulated 110,000 km.

The decisive year for Roger Agache was 1980. In March, a manufacturer of automobile accessories and industrial supplies, the Chenesseau company, joined him in his adventure thanks to the intervention of ANVAR (National Agency for Implementation of Research)-Centre. The first prototype was in operation five months later. One year

after that, the endurance tests of the pre-production engine confirmed the validity of the option that they adopted: build an engine specifically designed for alcohol consumption, rather than adapt an existing conventional or diesel engine, an approach which has always resulted in problems.

The originality of the Moteurgaro lies in its high-pressure injection during the compression cycle, which encourages internal mixing, and in its combustion chamber, whose geometry assures charge blending and centrifugation leading to stratification and concentration in the ignition zone. Combustion can thus take place despite the overall leanness of the mixture. The only drawback of the design is a high exhaust noise resulting from an unusual effective average pressure, which has required the development of an adapted muffler.

The measurements made during 1981 showed very positive performance results. Torque and power are higher than the best known figures: 13.5 hp per liter of cylinder volume and per 1000 rpm, a value which is reached only by turbocharged engines. The torque remains constant from 1000 to 2400 rpm, and the power is 33-49 percent higher than that of a diesel engine with the same cylinder capacity. Moreover, the maximum temperature remains below the usual levels, thus doubling the lifetime of the oil. A clean fuel, methanol produces very little nitrogen oxides and CO, and does not corrode engine parts. And finally, the combustion acceleration is such that ignition advance with cold spark plugs can be set at a very low value, constant for all engine speeds.

The first application will be on a light tractor for rice cultivation in tropical areas, to replace a conventional 67-75 hp diesel. Particular attention was devoted to power control, so as to respond to all utilization conditions. A pressurized tank and modified fuel supply system avoid the evaporation and vapor lock phenomena that are unavoidable in that climate. Ignition is provided by a magneto for simplicity and reliability. This engine also appears as an ideal solution for emerging nations that are not oil producers, but whose vegetal resources permit local production of methanol. And eventually, it might also become interesting to industrialized nations.

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BRIEFS

'WREN SKYSHIPS' FOUNDED--A new company, Wren Skyships was founded in London on 31 March to build a new type of rigid dirigible with an aluminum shell, which could carry a useful load of 18 tons at speeds of 135 knots (about 220 km/h). Its founder is Major Malcom Wren, an engineer who several years ago had created another enterprise, Airship Industries, to reinstate dirigibles as a means of transportation. Last year, Airship Industries produced its first soft skin prototype, the Skyship 500, which should be followed by commercial versions; and the Walloon Regional Society for Investments decided 15 days ago to join it, aiming at the transfer of some of the company's production units to Wallonia. However, Major Wren has decided to separate himself from Airship Industries in order to concentrate on the new type of airship. According to him, the pressurized rigid shell will allow much higher speeds than conventional soft skins. It will also be possible to equip it with jet deflectors which will facilitate maneuvers at lower speeds, and utilization will be possible in all weathers. He added that negotiations are under way for financing the project, including the outfitting of a manufacturing shop in North America. [Text] [Paris AFP SCIENCES in French 1 Apr 82 p 46] 11,023

LONGER-RANGE A310 PLANNED--As part of a continuing product improvement program, Airbus Industrie plans the development of the A310-300, an A310 version with longer range and increased takeoff weight. The maximum permissible takeoff weight of the A310-300 will be 149 tons as compared with 132 or 138.5 tons (option) for the A310-200. The range with 218 passengers is 7,135 kilometers with the normal fuel reserves (more than 8.5 flying hours) whereas the A310-200 has a range of 5,000 kilometers (5,930 kilometers for the 138.6-ton option). The company considers that the A310-300 is the ideal aircraft to [replace] the classic four-jet older generation aircraft on medium and long routes. Among other things, the A310-300 offers a fuel saving of up to 40 percent per seat. [Text] [Duesseldorf VDI NACHRICHTEN in German 9 Apr 82 p 20] 8373

SKF AIRCRAFT CERAMICS, COMPOSITES--Would you feel safer at an altitude of 10,000 meters if you knew that the balls in the aircraft engine's bearings were made of ceramic and that the rods actuating the control surfaces were made of plastic? However you might feel, that development is underway. The Swedish Ballbearing Works (SKF) is at work in its laboratories to produce balls of silicon nitride--a ceramic material that is compressed and heated together (sintered) from powder. The advantage of the new balls is that they would be 60 percent lighter than steel balls, that friction--and thus heat generation--would be lower, and that ceramic is harder than steel. It does seem that ceramic would be brittle, but the SKF says that the balls could not crack under any circumstances. As in the case of steel balls, the wear would occur on the surface. In addition, ceramic balls would withstand the high temperatures in aircraft engines better than steel. The same firm is also working in France to produce parts of the frame structure constituting the fuselage of an airplane or helicopter out of carbon fiber-reinforced plastic. It wants to use the same material in the push-rods used by the pilot to control the movements of the aircraft's various flaps. In this case, a reduction in weight is the main goal, but militarily, there is another advantage: a shot fired through a carbon fiber rod leaves only a hole, and the rod is not ruined. [Text] [Stockholm SVENSKA DAGBLADET in Swedish 12 May 82 p 14] 11798

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